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THE THEORY OF INDICATORS AND ITS BEARING ON THE ANALYSIS OF PHYSIOLOGICAL SOLUTIONS BY MEANS OF VOLUMETRIC METHODS.

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I. INTRODUCTION.

For a considerable period of time clinicians have been in the habit of basing their diagnoses of cancer and other pathological conditions of the stomach to no small extent on the results obtained from the chemical analyses of the contents of that organ. There is also an increasing tendency to titrate blood serum, urine, etc., with a view to throwing some light on the nature of the pathological changes involved in faulty metabolism. One factor which has eris-

ously militated against proper correlation and utilization of these results has been the promiscuous employment of widely differing types of indicators, with the result that the figures obtained by different investigators are seldom comparable. When, therefore, a series of experiments was commenced in this laboratory with the object of affording, so far as possible, a clear insight regarding the nature of the disturbances in metabolism taking place in cancer and allied conditions, it became necessary to systematize existing methods or adopt new ones. A careful consideration of the published work of clinicians, in so far as chemical analyses are concerned, makes it apparent that the empirical results, more or less dependent upon the individual who obtains them, are fairly satisfactory so far as he personally is concerned, but are possessed of little scientific value. More especially is this the case when volumetric methods of analysis are employed, probably owing to the failure of the majority of workers in this field to fully appreciate the significance of the end-points of individual indicators or the nature of the extremely delicate problems in chemical equilibrium with which they have to deal. The principal object of this preliminary paper is to clearly outline the nature of the various classes of indicators used in acidimetry and alkalimetry; to study their behavior towards various weak bases and acids which may occur in the course of physiological work; further, to make a series of tests on artificial and normal stomach contents, pancreatic digests, blood serum, etc., all as an introduction, so to speak, to subsequent publications dealing with pathological conditions such as are met with in cancer of the stomach, the blood of cachectic cancer patients, etc.

Incidentally it may be remarked that work of this nature can be utilized to throw light on the constitution of the proteid molecule and the numerous products resulting from the various stages of peptic or tryptic digestion, or from the intervention of bacteria and abnormal enzymes.

II. REGARDING THE NATURE OF INDICATORS AND THEORY OF THEIR ACTION.

The indicators employed may be divided into three more or less artificial groups:

(1) Those which are especially sensitive to alkalies, as, for example, benzo-purpurin, congo-red and lakmoid, and may consequently be employed for titrating very weak bases.

(2) Those which are equally sensitive both to alkalies and acids, as for example, alizarin, hæmatoxylin, lakmus and rosolic acid, indicators which would be employed by preference when we have to deal with mixtures of moderately strong acids and bases.

(3) Those which are especially sensitive to acids, as, for example, phenolphthalein, Porrier's blue, etc., indicators which would be employed by preference in estimating the quantity of any extremely weak acid.

Indicators of the type enumerated above belong to the group of organic dyestuffs, and are endowed in addition with more or less marked acid properties ranging from those in the first class referred to above which possess one or more strongly negative or acid groups, to those in the third class, the acid properties of which are extremely weak. The color changes observed on titration are attributable to the formation of a salt of the indicator in question possessed of a different color to that of the original acid from which it is derived. This result is obtained, just as would be expected, at that point at which all the acids in the solution which are stronger than the acid group of the indicator, and consequently possessed of a greater affinity than the latter for alkali, have been neutralized. It will thus be seen that in order to titrate the weakest possible acids it is simply necessary to find indicators which possess even weaker acid properties and less affinity for bases than those possessed by the weak acid in question. It is also obvious that if we desire to determine the proportions of two or more acids present in a solution, this may be readily effected, provided the acids in question differ sufficiently in strength to enable us to find indicators possessing acid affinities lying intermediate between those of the acids involved. There are considerable limitations to the extension of this scheme, one of the principal difficulties being the impossibility of obtaining sharp end points with extremely weak acids or bases, owing to the slow and incomplete formation of salts and consequent imperfect dissociation of salts into ions, upon which the color reactions really depend.

It is a general principle in volumetric analysis that strong bases should be employed to titrate weak acids, and strong acids to titrate weak bases. This is due to the fact that weak acids and weak bases only combine with considerable difficulty to form salts and the speed of reaction even at high temperatures is extremely slow.

Attention has already been drawn to the fact that indicators are for the most part acids ranging from those in the first group possessed of considerable affinity for alkalies, and consequently more suitable for the titration of bases, to those of the third group which have the weakest acid properties, and are consequently capable, as has been explained above, of being employed as indicators for the titration of dilute acids, provided strong bases are made use of in the standard solutions. We have already considered the *modus operandi* of the third group. As we ascend the scale to the second group possessed of more marked acid characteristics it necessarily follows that the indicators of this group are less sensitive to weak acids than are those of the third group, owing to the fact that the acid properties of such indicators are more nearly equivalent to those of the weak acids which have to be titrated. They are, however, still capable of reacting with strong mineral acids, and are more sensitive to bases than are the weak acid indicators of the third group. Phenolphthalein and Porrier's blue, for example, members of the third group which may be employed for titrating the weakest organic acids, give sharp end points with soda and potash, but not with ammonia. Hæmatoxylin, belonging to the second or middle group, is capable of giving a sharp end point on titrating with ammonia, but cannot be employed for estimating the amount of weak organic acids in a solution.

As we pass from the second to the first group of indicators the acid properties become even more marked. These indicators are for the most part sulphonates of diazo compounds and possess several OH groups in addition. They are sufficiently strong acids to form salts with relatively weak bases; but, on the other hand, owing to their strongly acid characteristics, are quite indifferent to the presence of weak organic acids in solution. We have in the solution a weak base to be titrated, also a small quantity of the salt of the indicator acid. The color change is brought about when the weak base being titrated has been completely neutralized by the acid employed for titration and the slight excess of the acid added results in the liberation of the indicator acid from its salt. Differentiation between bases of different strength by means of indicators of the first group, whilst not so readily effected as is that of acids in the third group, is still perfectly feasible. Some of the indicators of the first group, as for example, phloroglucinvanillin, depend for

their action on the property which they possess of first reacting with the strong acid present in the standard solution employed for the titration after all the basic affinities present in the solution have been satisfied.

In addition to the group of indicators dealt with above others may be mentioned, such as dimethyl-amido-azo-benzol and methyl-violet, characterized by their basic instead of acid properties. Dimethyl-amido-azo-benzol being a weak base falls into class one of indicators sensitive to bases. When bases are being titrated by means of acid standard solutions the salt of the basic indicator is only formed after complete saturation of the bases stronger than it which are present in the solution. Still another group is characterized by the possession of both acid and basic properties. To this group belongs methyl-orange and the gradual transition of this substance from a yellow to a pink with an intermediate phase is attributed to the probable existence of a multivalent ion in the solution, an ion possessed at the same time of positive and negative characteristics. Wagner, in an exhaustive study of this question, differentiates still a fourth type of indicator of which alizarin sulphonic acid may be taken as an example, possessed of two negative groups capable of reacting independently according to circumstances. This indicator possesses a SO_3H group and an OH group. The neutralization of the former with alkali leads to the formation of a red color and the saturation of both to a purple. This differentiation is most marked in titrating phosphoric acid which possesses three acid groups differing considerably in their affinity for bases. The first acid group of the alizarin indicator is weaker than the first acid group of the phosphate, but stronger than the second. The second acid group of the indicator is weaker than the second, but stronger than the third acid affinity of the phosphoric acid. As a consequence we have a sharp transition from green to red on neutralization of one of the acid affinities of the phosphate molecule and a further transition from red to purple after two of the phosphate affinities have been saturated.

There is nothing to be gained by further multiplying cases of the great variation in sensitiveness of different indicators and even of one and the same indicator under varying circumstances. One important point should always be borne in mind, viz., the end point is always much sharper when the completion of the reaction results

in the formation of a salt of the indicator, whether the indicator be acid or basic, than when the change in question results in the liberation of a free acid or base.

An attempt will be made in the course of the succeeding paragraphs to show to what extent acids and bases possessed both of strong and weak affinities may be differentiated by means of the range of indicators at our disposal. It must, of course, always be remembered that, except in the case of those indicators which are exceptionally sensitive to acids, and therefore not appreciably to bases and *vice versa*, a marked interference must necessarily be introduced wherever there is a tendency on the part of an indicator to be affected by both acids and bases.

This is not the place to deal further with the constitution of indicators and the theory of their dissociation in solution with the formation of ions and the effects of dilution, etc., upon this degree of dissociation. It is merely necessary to state that both practically and theoretically certain indicators are particularly sensitive to extreme dilution, and consequently should be employed in as concentrated solutions as is possible.

III. BEHAVIOR OF INDICATORS TOWARDS MINERAL AND ORGANIC ACIDS.

In these experiments titrations were carried out by means of n/10 NaOH and n/10 H_2SO_4. In addition, n/10 ammonia, n/10 oxalic acid were employed when required. N/10 solutions of the following acids, hydrochloric, phosphoric, oxalic, formic, lactic, propionic, butyric, aspartic and malic, were prepared with the greatest accuracy. In the case of the mineral acids, gravimetric methods were employed for the determination of the strength of the solution. In the case of the organic acids, the greatest precaution was taken to obtain pure, ammonia-free preparations, and the exact strength of the solution was in each case determined by the use of phenolphthalein and in the majority of cases confirmed by the use of Porrier's blue. Both these indicators are extremely weak acids and belong to Group 3, referred to above. The following indicators, dissolved in the most suitable solvents, were then tested in conjunction with each of the acids enumerated above, effect of time and temperature being especially noted. Of the first group, dimethyl-amido-azobenzol, methyl-orange, benzo-purpurin and cochineal in solution, and congo-red and lakmoid, both in solution and on strips of paper, also

drops of phloroglucinvanillin, tropæolin and sugar resorcin on a warm porcelain plate, were employed. In the second group, alizarin, hæmatoxylin, lakmus, rosolic acid and guaiac tincture, and in the third group tropæolin 000, phenolphthalein, alpha-naphthol-benzine and Porrier's blue were made use of.

It would, of course, be impossible, with the limited space at our disposal, to tabulate all the results obtained. Such a work would in any case be superfluous. The great majority of indicators were found, for some reason or other, to have little value in dealing with physiological solutions owing to their complete failure to give definite end points. These experiments were necessarily carried on at the same time as those enumerated in Sections 4 and 5 on bases, proteids, albumoses, etc.; as a result, many indicators possessed of considerable value for differentiating acids had to be ruled out of consideration on account of their failure to give a sharp end point in the presence of weak bases.

In order to effect an economy of space the general tables of this section have been omitted, the most important points being summarized in the following paragraph:

Notes and Conclusions.—Phosphoric acid may most readily be titrated, making use of alizarin as indicator for the determination of the first acid group of phenolphthalein to indicate the termination of the second acid group, and of phenolphthalein in the presence of barium chloride and an excess of alkali in a boiling solution for indication of complete saturation of all the acid affinities.[1]

(2) Phenolphthalein gives a good end point for determining the total acidity of any of the acids enumerated above, with the exception of the third acid group of phosphoric acid, and failing beyond the first acid affinity of malic and aspartic; but on account of its sensitiveness to ammonia cannot be employed in the presence of large quantities of that substance, as will be seen later.

(3) Porrier's blue may be employed in the place of plenolphthalein where large quantities of ammonia are present, as it is entirely indifferent to that substance. It is also slightly more sensitive than phenolphthalein to some of the weaker organic acids, but, generally speaking, gives an inferior end point, consequently its employment

[1] See this JOURNAL, July, 1903. A note on the quantitative estimation of phosphates in stomach contents.

is not to be recommended when phenolphthalein is equally serviceable.

(4) The differentiation of organic acids, generally speaking, from mineral acids, may in the absence of phosphates be most readily effected by means of phloroglucinvanillin drops on a porcelain plate, the temperature of which is kept slightly below the boiling point of water, the end point being that point at which the faint pink finally disappears, and does not reappear on cooling. Dimethyl-amido-azo-benzol, commonly employed in volumetric work, is practically useless for this purpose, unless the observer be especially trained to note the first change from pink to orange red. This indicator is not to be recommended. Tropæolin oo may be utilized to distinguish between mineral and organic acids when used in the form of drops on a hot plate, if the precaution is taken of observing only a permanent purple end point and not a temporary brown coloration. In the presence of phosphates phloroglucinvanillin drops give a slight reaction, but with experience in using the method the effect produced by phosphates, especially when present in small quantities, may be disregarded. With tropæolin, whilst hydrochloric and sulphuric produce a permanent purple coloration, phosphoric acid first produces merely a permanent faint slate color, and that stops short of the complete saturation of the first acid affinity of this substance.

(5) Carbonic acid exhibits most interesting characteristics. Sodium carbonate, Na_2CO_3, when dissolved in water, is neutral to Porrier's blue. The phenolphthalein end point is obtained after saturation of one of the sodium affinities with acid, and the end point of alizarin, hæmatoxylin, methyl-orange, and especially of the phloroglucinvanillin drops, is first obtained after complete saturation of all the sodium present with strong mineral acid. In other words, Porrier's blue is the only indicator which recognizes both acid groups of the hypothetical carbonic acid. Phenolphthalein is sensitive to one of them, and the other indicators enumerated are entirely indifferent to their presence.

(6) The great bulk of indicators give more or less reaction with organic acids. Very few of them, however, can be said to afford a satisfactory final end point. It is possible, for example, to obtain an end point including all mineral acids and such organic acids as lactic, butyric, etc., provided the first color changes are disregarded

and only the final end points observed, by employing such indicators as alizarin, hæmatoxylin (?), litmus, benzo-purpurin, rosolic acid, etc., but for some cause or other the majority of these indicators are ruled out by later experiments. There is, however, a noticeable difference in the behavior of the organic acids towards the same indicator as regards the first appearance of the color change and final end point. The strength of these acids diminishes as we ascend the series, as would be expected from our knowledge of their constitution.

IV. BEHAVIOR OF INDICATORS TOWARDS BASES, SODA, AMMONIA, ETC., AND THE AMIDO BASES.

In this work, which was carried out simultaneously with that recorded in a previous section, the same series of indicators was employed. All indicators give sharp end points with NaOH and KOH. Towards ammonia Porrier's blue is practically indifferent when properly employed. Phenolphthalein is materially affected, giving an end point extending over ·4 to ·5 c.c. when 10 c.c. of n/10 solutions are employed. This indicator cannot, therefore, be used in the presence of any considerable quantities of ammonia. Alizarin, litmus, dimethyl-amido-azo-benzol, rosolic acid and methyl orange give a better end point than that of phenolphthalein, but still far from satisfactory. Hæmatoxylin and congo-red give sharp end points so long as strong acids are employed for titration. Drops of phloroglucinvanillin, tropæolin, etc., give the sharpest end points.

Having observed the behavior of indicators towards ammonia, a fresh series of experiments was carried out with a series of amido acids, asparagin, glycocol, leucin, tyrosin and aspartic acid with a view to observing the effects produced by the weak NH_2 groups present in each of these compounds upon the indicator in question. Exact n/10 solutions of these substances were prepared, and their behavior towards certain typical indicators compared with that of the ammonium salts of formic, acetic, lactic acid on the one hand, and bodies like acetamid, formamid and urea on the other, and the results tabulated. See Table I. In order to insure as great accuracy as possible, an effort was made to employ an amount of substance which should require 25 c.c of a n/10 solution for the recognition of each acid or alkali group, especially where such indicators

as phloroglucinvanillin drops were concerned. All the results have, however, been reduced to the equivalent of 100 c.c. of a n/10 solution in order to afford a uniform means of comparison. Thus, if in one case 10 c.c. of a solution had been employed on account of scarcity of material, and in another case 25 c.c., the former would be multiplied by 10 and the latter by 4 in order to make the results comparable. It will be seen on examining the figures that Porrier's blue is sensitive to all the free acid groups and entirely indifferent even to ammonia and certainly to NH_2, etc. Phenolphthalein lies next, being less sensitive to acid groups and far more sensitive to

TABLE I.

Substance Titrated, 100 c.c.	Porrier's Blue.	Phenol-phthalein.	Alizarin.	Phloro-glucinva-nillin.	Nitrogen.
N/10 ammonia	Nil	— 100	— 100	— 100	100
N/10 formic acid + 100 c.c. n/10 ammonia	+ 105	+ 14	+ 3	— 105	100
N/10 acetic acid + 100 c.c. n/10 ammonia	+ 105	+ 8	+ 10	— 110	100
N/10 lactic acid + 100 c.c. n/10 ammonia	+ 110	+ 8	+ 10	— 105	100
N/10 malic acid	+ 100	+ 100	+ 100	Nil?	Nil
N/10 solution pure asparagin	+ 100	+ 25	Nil	— 100	200
N/10 glycocol	+ 100	+ 3	Nil	— 100	100
N/10 leucin	+ 95	+ 5	Nil	— 95	100
N/10 aspartic acid	+ 200	+ 100	+ 100	— 100	100
N/10 tyrosin (impure)	+ 117	+ 40	Nil	— 117	115
N/10 asparagin (impure)	< + 100	+ 22	+ 1	— 114	220
N/10 acetamid	Nil	Nil	Nil	— 5	100
N/10 formamid	+ 15	+ 3	+ 1	— 15	100
N/10 urea	Nil	Nil	Nil	— 6	200

ammonia than is Porrier's blue. Alizarin, the third representative we decided to use after trying a considerable number of indicators, is sensitive both to ammonia and to strong organic acid groups, so that ammonium acetate, ammonium formate, etc., are neutral. But whilst fully sensitive to ammonia in all cases, alizarin is apparently indifferent to the weak acid groups such as are present in asparagin, tyrosin, etc., and also to the amido group of those same compounds. Phloroglucinvanillin drops which, after employing various indicators, we decided upon as most valuable for weak bases,

is entirely indifferent to all weak organic acids, whether of the nature of aspartic acid or the stronger types, such as formic, acetic, lactic, etc. This indicator is of great value in differentiating the weak bases, being sensitive not only to ammonia, but also to the NH_2 group in asparagin, glycocol, leucin, tyrosin and such compounds as hydroxylamin, but indifferent to the NH_2 groups of the type present in acetamid, formamid and urea, groups that are associated directly with negative CO.

Meyer and other investigators have made the assumption that the amido acids are entirely devoid of basic characteristics. These results, however, make it apparent that a sharp differentiation between ammonia, the NH_2 group associated with carbon, to which hydrogen is attached, and the NH_2 group associated directly with the CO group, may very readily be effected.

An interesting phase of this work is shown in the results obtained rom impure tyrosin and asparagin. In both these cases the high nitrogen content indicated the probability of the formation of some type of anhydride through internal condensation. This result was entirely borne out by the figures obtained in titration after the substance had been dissolved in water, whereby any such anhydride would probably be decomposed. As a result the end point obtained with phloroglucinvanillin drops corresponded exactly with the difference that our nitrogen determination had led us to expect. The same agreement of errors attributable to impurity of the substance was observed to a modified degree in leucin. Not having methylamin or æthylamin at our disposal we were not able to test their behavior towards indicators; but from the literature it would appear probable that bodies of this type would exert, just as does ammonia, a full alkaline effect upon alizarin, and possibly even on phenolphthalein. Such bodies as æthylendiamin, having two NH_2 groups, are probably mono-basic to phenolphthalein and di-basic to alizarin, but this question will be referred to at a later stage in discussing the constitution of the proteids.

A consideration of the bearing which these results have upon the titrations of stomach contents and the constitution of the proteids, will be reserved until the action of the indicators here employed has been studied in its relationship to the various nitrogenous products present in such mixtures. The most important result of the work recorded in this section is the means which it affords of differentiat-

ing between various weak basic groups all in the presence of one another without interference with one another by means of the four indicators enumerated above.

V. BEHAVIOR OF INDICATORS TOWARDS PROTEIDS, ALBUMOSES, PEPTONES, ETC.

In order to test the effect on indicators of proteids and various products obtained from the latter by partial or complete hydrolysis, we made use of albumin solutions and solutions of Witte's peptone, especially prepared, artificial peptic digestion of egg-white, tryptic digestion of egg-white, etc.

(1) The behavior of egg albumin was tested by separating the white of two eggs and thoroughly admixing. Portions of 10 c.c. were then removed and titrated with phenolphthalein, alizarin and phloroglucinvanillin, and 1 c.c. quantities were made use of for the estimation of nitrogen. This same experiment was repeated with two more eggs, the only difference being that in the second case the egg-white was first thoroughly admixed with ten times its volume of water before making titrations and determining nitrogen. Results are as follows:

EXPERIMENT 1.

10 c.c.	= 1·1 c.c. acid to phenolphthalein.
"	= 7·6 c.c. acid to alizarin.
"	= 20·6 acid to drops.
1 c.c. N	= 12·6 n/10 acid,

from which it will be noticed that the portion from phenolphthalein to alizarin is about one-half of that from alizarin to drops, and that the whole range from phenolphthalein to drops is about one-sixth of the total N.

EXPERIMENT 2.

100 c.c. of the diluted solution	= 1·6 c.c. acid to phenolphthalein.
" " " " " "	= 8·0 c.c. acid to alizarin.
" " " " " "	=22·0 c.c. acid to drops.
Nitrogen 1 c.c.	=13·0 c.c. n/10 acid,

from which it will be noticed that the phenolphthalein to alizarin bears about the same proportion to that from alizarin to drops, 1 to 2, as in the previous case, and also that the total effect on indicators in titration is about one-sixth of the total nitrogen equivalent, as previously observed.

Several series of experiments were carried out, making use of the solutions of Witte's peptone, varying in strength from complete saturation to 1 per cent. This substance was employed for testing indicators in preference to stomach contents and artificial peptic mixtures, owing to its relative purity and freedom from inorganic impurities capable of producing a disturbing effect upon the end points, and also on account of the ease with which the small quantities of such substances present can be determined. The experiment was repeated on five separate occasions, peptone solutions of different concentrations and obtained from different batches being employed. In order that there should be no possible source of error due to decomposition of the peptone solution, each series of experiments was carried out in the space of twenty-four hours, as follows:

In the first case a saturated solution was obtained by shaking repeatedly 100 grammes of peptone with 10 liters of water, filtering and completely admixing the filtrate. From this clear solution 100 c.c. portions were removed for titration alone and in the presence of various acids by using each of the indicators under investigation. At the same time 200 c.c. batches were removed for the estimation of those substances capable of acting on indicators, phosphates, chlorine salts, total chlorides and ammonium chloride and organic acids, all experiments being made in duplicate. The nitrogen content of the solution was also estimated by removing 25 c.c. portions for direct Kjeldahl determinations and 50 c.c. portions were treated with an equal amount of 20 per cent. phosphotungstic acid at 70°, filtered and nitrogen estimated in the filtrate. In this case 100 c.c. of the solution was found to contain nitrogen equivalent to 92 c.c. n/10 alkali. The amount of substance capable of materially affecting the end points of indicators was practically negligible, hydrochloric acid being less than ·3 c.c., phosphoric acid ·2 c.c., and organic acids less than ·1 c.c. of n/10 alkali.

Volumetric determinations, carried out with both warm and cold solutions, between which little difference in results was observed, show as an average:

Porrier's blue indefinite, 100 c.c. peptone = over 4·0 c.c. alkali.
Phenolphthalein, 100 c.c. peptone = 4·0 c.c. alkali.
Alizarin, 100 c.c. = 4·0 acid.
Litmus, 100 c.c. = 2·5 to 3 c.c. acid, from purple to red. End point indefinite.
Phloroglucinvanillin drops, 100 c.c. solution requires from 20 to 20·5 c.c. n/10 acid.

Tropæolin drops, 100 c.c. solution requires from 22 to 22·5 c.c. n/10 acid.
Diazo, yellow-green reaction at the start gives orange-pink end point first about 15 c.c. End point indefinite.
Hæmatoxylin, congo-red, methyl-orange and rosolic acid give indefinite end points.

It will be seen from these figures that for 100 c.c. of solution there is a difference between phenolphthalein and alizarin end points of approximately 8 c.c. n/10 acid or alkali. Of this amount less than one-tenth part can be acounted for as combined HCl, acid phosphates, organic acids and other impurities. The effect observed must consequently be attributed to the peptone itself, probably to the weak basic groups contained in its molecule. Of the portion equal to 4 c.c. from the commencement to the phenolphthalein end

TABLE II.
Titration of Peptone Solutions.

No.	Phloroglucinvanillin Drops, End Point.	Alizarin End Point.	Phenolphthalein End Point.	Total Range Drops = Phenolphthalein End Point.	Drops = Alizarin.	Alizarin = Phenolphthalein.	Total Nitrogen.	Impurities—Maximum Effect.		
								HCl, Free and Combined with Proteids.	Phosphates.	Organic Acids.
1	−7·5	−1·6	+1·6	9·1	5·9	3·2	36·2	·1	—	Nil
2	−20·0	−4·0	+4·0	24·	16	8	92	·3	·2	·1
3	−34·0	−5·7	+5·1	39·1	28·3	10·8	131	·5	·4	—
4	−64·0	−13·4	+8·2	72·2	50·6	21·6	242	·8	—	—
5	−70·0	−17·0	+12	82·0	53·0	29·0	281	·9	·8	—

point, less than one-tenth can be accounted for as due to combined chlorides.

The period from phloroglucinvanillin end point to that of phenolphthalein is twenty-four, about three times that from alizarin to phenolphthalein and less than one-quarter of the equivalent of the total nitrogen present in the solution.

In the following table we have recorded results obtained with solutions of Witte's peptone varying from ·03 to ·4 per cent. nitrogen. To make clear the relationship between the nitrogen content and the titration from the phloroglucinvanillin drops' end point to alizarin and alizarin to phenolphthalein, we have recorded in one

column the amount of n / 10 acid equivalent to the nitrogen present in 100 c.c. of the solution. The titration results for 100 c.c. to the drops' end point, to the alizarin end point, and to the phenolphthalein end point are to be found in the first three columns, n / 10 acid being indicated by a — quantity, and n / 10 alkali by a + quantity. For the sake of comparison with the nitrogen content, three columns showing the range from drops to phenolphthalein, from alizarin to phenolphthalein, and from drops to alizarin have been included. The average of the seven different concentrations gives a period from drops to alizarin about twice that from alizarin to phenolphthalein; consequently the total range from drops to phenolphthalein is three times that from alizarin to phenolphthalein. A comparison of these figures shows a relationship of 3 : 1 : 2 : 10·5 for these three quantities as compared with the nitrogen.

From these results it appears possible that some sort of relationship obtains between the various types of nitrogen-containing groups in the proteid and the end points of various indicators. This question will be further considered in the next portion of this paper dealing with artificial peptic digestion. One point, however, is clearly brought out by the use of Witte's peptone: that the amount of impurities retained by the peptone hydrochloric acid, phosphates, organic acids, etc., which could produce an effect upon indicators is too small to account for any of the recorded figures.

[*To be continued.*]

PHARMACY AND CHEMISTRY AT THE WORLD'S FAIR.

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(*Continued from p. 413.*)

IV. FRANCE: A LIVE PHARMACEUTICAL AND CHEMICAL EXHIBIT.

In the very large French section of the Liberal Arts Palace we find an extended display made by enterprising chemical and pharmaceutical firms. Here are not only polite guards who do give you intelligent replies to inquiries about exhibits, but also technical and commercial experts representing the separate firms. What a pleasure it is to find oneself at home after a visit to the British section!

"La chimie est une science Française." While this celebrated statement of Wurtz is a trifle too broad, still it must be admitted

France gave a wonderful impetus to scientific and technical chemistry; it boasted the greatest chemists of the ending eighteenth and beginning nineteenth centuries. To-day it is as active as ever in promoting chemical and the allied pharmaceutical research, and that it makes itself felt is seen from the great interest taken in the scientific exhibits by professional men.

In examining the wooden manner of exhibit made by the German chemical commission, I saw such important discoveries as the hydrides of barium and strontium overshadowed by crude strontium sulphide! Why should such important work, by the Nestor of German chemical science, Clemens Winkler, be hidden from the eyes of American chemists? Have the French made the great mistake of showing a so-called "educational exhibit," that hides research work of highest importance among common everyday articles of chemical manufacture? Not by any means. The French show the important research work by itself in a very prominent manner. It would be impossible to miss the separate exhibits of the Société Chimique de Paris, M. Béhal, M. Moreau and others, showing in separate cases to great advantage.

THE AMERICAN JOURNAL OF PHARMACY'S representative had the great pleasure of meeting Monsieur le Professeur Auguste Béhal, a gentleman of unassuming and pleasing personality. Upon my request that he point out a few of the many discoveries made by himself in organic chemistry, he consented to give me those illustrating class reactions. By a class reaction is meant one that, followed up, will lead to the production of many new compounds.

Professor Béhal is the author of an extended organic chemical text. He is professor in the Paris School of Pharmacy; many of his discoveries relate to pharmaceutical products. I copy from the notes written by him in my note book: Analysis of officinal creosotes and studies on derivatives, guaiacol, studies on a new class of dicetones, derivatives of chloral such as mono- and di-chloralantipyrin, derivatives of chloralimide, on the isomers of estragol, mixed anhydrides of formic acid and their ethers, on campholenique series, etc. I find in Actualites Chimiques, Tome II, pp. 377-407, his very complete exposition of the structure of camphor. In a separate case will be found several hundred organic compounds made by M. Béhal.

On the 4th of June, 1857, three young chemists, Arnaudon,

preparateur of Chevreul, Collinet, preparateur of Dumas, and Ubaldini, conceived the idea of meeting to discuss work accomplished by the chemists in the great scientific center—Paris. Friedel, Perrot, Wurtz, Barreswill and other noted chemists of the time soon endorsed the idea of their assistants, and the Société Chimique de Paris was an established fact. To-day this is one of the most important scientific bodies in the world, and publishes a bulletin of over 3,000 pages annually. Since 1900 its members have discovered over 2,000 new compounds, which form one of the most remarkable scientific exhibits of the World's Fair. Though each sample is shown in a small glass only, still they require a large 6 by 12-foot case to house them all.

One of the most striking exhibits in the case are the delicate tests of Armand Gautier, proving that arsenic is found in all articles of food, and in all parts of the animal organism. Of course, the per cent. is very small. Only his most refined method of analysis could reveal the minute traces of arsenic present. The small apparatus actually used by Gautier is also shown. This consists essentially of three parts: an evolution flask, a decomposing tube and the mirror deposition tube. The first is essentially a small three-tubulatured Wolff bottle, holding not over 200 c.c. The central tubulature has a ground-in-glass separatory funnel; this is to hold the acid liquid to be tested. The second is a safety tube, that, by simply pressing a Mohr's pinch-cock, allows, when too rapid an evolution of hydrogen takes place, this gas to bubble through a silver solution. The third is the exit tube; this has a small bulb to catch acid mechanically thrown upwards; from this a wide tube admits of the introduction of caustic potash to retain antimony, to dry the gas and remove all traces of acid.

The now thoroughly purified gas passes to the reduction tube; this is a thin, hard glass tube encased in close-woven copper netting, and heated to redness for fully 6 inches of its length in a minute combustion furnace. At the end of the furnace an asbestos shield prevents direct heat radiation warming this portion; a linen cloth wrapped about the tube, continually wetted with water, causes a prompt cooling of the gases, and a sharply defined mirror deposits in the thin tube extension. Any undecomposed gases pass into the silver solution, where the arseniuretted hydrogen precipitates the silver. No such blackening is noted when reasonable care is exercised.

Wheat, hair and cuticle, nails, peas, muscular and nerve tissue and many other substances of animal and vegetable origin tested by Gautier were found to contain arsenic. An excellent method of destroying organic tissue was devised by him; it consists in alternately warming the material with concentrated nitric and sulphuric acids under the hood. Some thirty test capillary tubes showing arsenic are exhibited. I copied: Six egg membranes weighing five grammes showed only one thousandth of a milligramme of arsenic, which is a trifle more than the one hundred thousandth of a grain! One hundred grammes of muscle (beef) showed one thousandth of a milligramme; one quart of beer only one-fifth of one thousandth of a milligramme. You may wonder how he determines such minute quantities; it is by comparing the deposit made with test samples in which minimal but accurately known quantities were introduced into the generator and comparing the deposit with such standards.

The percentage in cuticle, hair and nails is greatest normally; so he concludes that arsenic is essential for the growth of these tissues.

From Southern France, the land of fragrant and delicate flowers, we see volatile oils, pomades and extracts. France is the home and center of the perfumery industry. Not only does it produce the most delicate of odors by enfleurage from the fragrant blossoms, but also innumerable synthetic perfumes in the French chemist's labotatory.

Hughes Ainé has an exceedingly tasty display of the natural odors. He shows beautiful imitation flowers twining about the jars containing their odor. Thus are displayed the rose, violet, tuberose, orange blossom, pomade extracts.

Chiris also has a very large case devoted to these products. Copper containers for volatile oils take up the corners of the display. Kilo pomade tins are placed at the base of the shelving, and contain jasmin, rose, tuberose and other products. Above are the extracts and volatile oils shown in vitro. Beautiful samples of cassie flowers, gum benzoin, castoreum, coumarine, together with the two large horns of civet and the six tonquin musk boxes, give us some insight of the perfumer's prime materials.

M. Charabot has a separate case devoted to some 100 samples of synthetic perfumes. Facing the British chemists on the outer aisle is the extended display of J. Dupont. Large bottles of synthetics such as Musc. S., Rubéol, Rhodénol, Heliotropin and the various

bisulphite products used as stepping stones to the pure aldehydes and ketones are instructive. Water-white synthetic pulegone, anethol, carvone, lynalyle acetate, ethyl benzoate and too many others to even mention, show that the French are very active in this important branch of modern chemistry, which is sometimes thought to be the exclusive province of another country.

Near these prime materials of the perfumer, the perfumer is himself in evidence. Of course, the French perfumer is a past-master in the arrangement of perfume displays, and also in the manner in which he prepares his perfumes for the trade. Of all the exhibits in this line at the Fair, that of E. Pinaud is the center of interest and the focus for all eyes. Mr. A. Veldhuisen, in charge, showed us the many relics that this firm has from the first empire. These comprise dainty articles that Napoleon and the Empress Marie Louise possessed. The ladies take special delight in the fountain of the unfortunate empress. This fount is continually supplying the delightful odor named after Marie Louise. A continual stream of visitors comes here to get fans, mirrors, etc., scented with this odor. The idea of Pinaud to specially push this article at the Fair, which only Napoleon rendered possible, is indeed a happy one. Samples of the various perfumes placed upon the market may be obtained by visiting druggists registering in the company's book. Their other specialties are Eau de Quinine, Foscarina, Violet Reine, Elixir Dentifrice, etc.

There are so many interesting features relating to industrial chemistry that one can only get an idea of them by spending several days at this one exhibit. For instance, Corban & Cie. make most wonderful chlorates. The crystals of sodium, potassium and barium chlorates shown are over an inch through. Chardonnet silk is made from cotton and the fibres of pine wood. The silk is of fine luster, and samples are dyed in all colors of the rainbow. In 1894 the firm used 5,000 hectoliters of alcohol; nine years later they employed more than six times as much in the manufacture of this silk.

Occasionally we run across graduates of the Philadelphia College holding important positions at the Fair. In examining the most elegant display of France's greatest chemical manufacturing house, Poulenc Frères, I met Mr. Louis J. Matós, a former assistant of Professor Sadtler, in charge. Dr. Matós was especially proud of the

many finely crystallized salts under his care. Bright red mercuric iodide is shown in large prisms, potassium iodide in large cubes, uranium nitrate in large inch crystals of a lemon-yellow tint, having a peculiar fluorescence in sunlight; one of the finest salts is the red prussiate of potash, truly red in color and finely crystallized. Iodoform in the form of crystals and powder; the former is beginning to find much favor at the hands of practitioners.

Large bottles of crystallized cacodylic acid and its salts; also methylarsenic acid and salts, both presenting arsenic in the organic form, less poisonous but still giving the strong alterative action of the inorganic salts. Many important mono-, di- and tri- varieties of the phosphates are exhibited in the form of crystals, crusts, powders and honeys. Also many lacto-, glycero- and chlorhydro- phosphates, many of which are nicely crystallized.

Of the elements, we find large cubes, really rhombohedræ of bismuth, sublimated iodine, silicon, boron, lithium metallic in long rods, and an aluminium-calcium alloy, presenting aluminium in a form that is very effective in the casting of sound steel.

Probably the most interesting of all is an anesthetic, "stovaine," a substitute for cocaine, that has none of the latter's toxic properties and still all the anesthetic qualities. This has not yet been put on the market in this country; it has been used with success in France in dental and other practice.

Large bottles of lecithine, glycogen, cholesterine, nucleinic acid used in certain cases as a nourishing adjunct, are made in large quantities by the firm.

A central portion of the case is taken up by vanadic acid and uranium salts obtained from Colorado carnotite. As an adjunct, some 75 grammes of radium-barium chloride obtained from 1 ton of the ore is shown. Many rare salts such as cerium, thorium gold and platinum compounds; also pure chemicals as used in analysis complete the exhibit.

Everything is arranged nicely in a very large case, samples are all of good size, and if you do not find Dr. Matós in charge, you usually see Mr. Sykes, the American representative. Or if you fail to see either of these gentlemen, the French guards in uniform are there to answer questions. I found M. Pierre Boissierée exceedingly attentive and polite, opening cases under his charge to explain many features; thus you see, the French are only too pleased to have visitors thoroughly examine and understand their exhibits.

La Pharmacie Centrale de France, also less known as the Pharmacie Centrale des Pharmaciens. Many in this country have heard in a hazy way of this, the greatest co-operative business ever floated. Conditions of Pharmacy changed rapidly in the beginning of last century; so much so that the great representatives of the art, Vauquelin, Soubeiran and others conceived of a central pharmacy of national importance, where drugs, chemicals and preparations could be obtained cheaply and of high quality. Testing of bought goods often cost them more in time than the goods themselves were worth, why not have all our goods tested at the Pharmacie Centrale by men doing this only?

But these dreams were premature. It took the great pharmacist Dorvault, fifty years later, to start the ball a-rolling, and it is rolling still. This great man said (how truly it also applies to our business): "The scarcity of students and obstacles of a material nature make it possible for a few pharmacists only to make all their preparations themselves. Without doubt it would be desirable to see the custom of the old pharmacy followed: that is, that all the compounded medicaments leaving a shop were really made therein. But greater and greater are the number of pharmacists that demand from the wholesale drug house those preparations that take time, or are difficult to make. Chemical products are becoming day by day more a part of the materia medica," etc. In other words, Dorvault, in his appeal to the pharmacists of France, complained that the pharmacist could no longer make his own preparations profitably; that making chemicals was even worse. He correctly goes on to state what little guarantee his brothers that bought goods from their then wholesalers had, so far as purity and the conformity to the Codex was concerned. Why should not the pharmacists make one great Pharmacie, in which each had stock and had a voice demanding that all must be made of high quality, that the Codex should be followed to the letter, and that goods sent out be standard—that is, tested. That stock could only be held by those who bought from the Pharmacie; in other words, Dorvault planned a co-operative company that was one in the strictest sense of the word. To-day the capital stock amounts to 10,000,000 francs.

The Pharmacie Centrale manufactures all preparations of the Codex; it deals in pure drugs and manufactures chemicals. Its stockholders can come and study in its laboratories, and it accepts

students who wish to follow the art. This grand idea that laid dormant more than fifty years till the man arrived, is a counterpart of the old professional pharmacy of 150 years ago.

In one pane the Pharmacie Centrale displays some pharmaceuticals, such as pills, perloids, minute seed-like pills of red and white tints, troches and other fine goods. In the second pane are their alkaloidal manufactures such as beautiful white silky quinine hydrobromate and hydrochlorate. Quinine dibromhydrate in heavy crusts, digitaline crystallized, in fact, a very nice display of alkaloidals of all kinds.

ALFRED H. ALLEN.

By Samuel P. Sadtler.

Alfred Henry Allen, F.C.S., well known to all chemists by his monumental work on "Commercial Organic Analysis," died July 14th, after an illness that appeared already ten years ago, and which he fought during that time, knowing that the malady in the end would conquer. Moreover, these ten years were among his most active; paper followed paper, volume followed volume, the work being broken only occasionally by journeys for his health to the South.

Allen began his career as a food analyst by serving as assistant to the late Dr. A. H. Hassall, well known by his work on "Foods and Their Analysis," and already in 1873 he was appointed as Public Analyst to the Corporation of Sheffield, and continued here in active practice until his death.

The Society of Public Analysts was founded by him in 1874, and whether as its President or on the Publication Committee of the *Analyst*, he was active in its service the remainder of his life.

He was one of the original members of the Society of Chemical Industry, founded in 1881, and active on its Publication Committee also until his death.

His great work, however, and by which he will always be most gratefully remembered by working chemists, was his "Commercial Organic Analysis," begun in 1879 and continued, volume for volume, through three editions down to the time of his death. This great work is an encyclopædia of working methods of prox

mate analysis and separations for organic compounds and mixtures of all kinds.

It is not a mere encyclopædia, however, in that it is an industrious compilation. It is, throughout, intelligently and discriminatingly written by one who either personally or by his assistants tried and proved every method, or where unable to do so the fact is clearly stated.

For chemist or pharmacist who does laboratory work outside of the narrow bounds of mineral analysis, the work is simply invaluable for reference and guidance. The last (third) edition was left unfinished at his death, but is coming out under the editorship of able workers like Dr. H. Leffmann and others.

Allen was a delightful personality and made many friends in this country, which he had visited several times. The writer met him first in 1884, when he visited Philadelphia at the time of the meeting of the American Association for the Advancement of Science. He was then eager to discuss new methods of analysis of organic products, and to visit manufacturing chemical works where he might learn something that would throw light on the problems he was looking into while writing his book.

The writer met him again on the occasion of a subsequent visit, and had correspondence with him and always found him the same eager inquirer. But he was not selfish in this; all he learned, whether by inquiry or by his own laboratory study, was freely given to the public in his "Commercial Organic Analysis," which he spared no labor to make as complete as possible.

He died at the relatively early age of 58, having achieved an honorable name in his profession, and left a grateful memory to all his many friends.

LABORATORY NOTES.[1]

By Frank X. Moerk.

Volumetric Estimation of Phenol.—In the process as usually followed, in which an excess of bromine v. s. is allowed to act upon the phenol in presence of hydrochloric or sulphuric acid, and titrating the excess

[1] Read at the twenty-seventh annual meeting of the Pennsylvania Pharmaceutical Association, June 21–23, 1904.

of bromine v. s. after the addition of potassium iodide with sodium thiosulphate v. s. with starch as indicator, the presence of the precipitated tri-brom-phenol interferes somewhat with the end-reaction; frequently in old phenol solutions the tri-brom-phenol possesses a bluish color which is not removable by an excess of sodium thiosulphate v. s. and which makes the end-reaction difficult. To overcome the difficulties mentioned I have recently been using a small quantity of chloroform (1 c.c. is sufficient), which is added after most of the brown color has been discharged by the addition of the sodium thiosulphate v. s.; the chloroform will dissolve the tri-brom-phenol and allow a very sharp end-reaction.

To those accustomed to making iodine-titrations in presence of chloroform it is needless to recall that the chloroform will dissolve and retain part of the iodine in solution, and that the sodium thiosulphate v. s. must be added as long as a blue color (due to the starch-iodide) is imparted to the aqueous supernatant liquid upon thorough agitation with the chloroform; in fact, it is possible to titrate without the use of starch-indicator, the end-reaction being known by a colorless aqueous solution and the chloroform free from any tinge of pink which is due to traces of iodine.

Any error caused by reaction between iodine and the chloroform can be compensated for by titrating the bromine v. s. with the addition of chloroform under precisely the same conditions as exist in this modified phenol determination.

Starch Indicator.—The deterioration of starch solutions has been the cause of much annoyance to those interested in analytical work. A large number of substances have been suggested as preservatives for starch solutions, but none of these are altogether satisfactory, and frequently the preservative is of such chemical character that the starch solution cannot be used for both qualitative and quantitative work.

Something over a year ago, as the result of a series of experiments which proved the above statements, the writer was led to try the action of oil of cassia as a preservative, influenced by a vague recollection of having seen some years ago a statement to the effect that oil of cassia had a remarkable preservative action upon some of the carbohydrates.

The experiment was a decided success, so that the solution made up in quantities of 1 liter could be used to the last drop. The starch

solution is made up in the usual manner, and after cooling 2 c.c. oil of cassia per liter of solution added and dissolved by agitation.

No objections have been noted to the use of this preservative in either qualitative or quantitative work, although the writer has been asked, on a few occasions, "Why our chlorine water smelled of cinnamon." The querists were using chlorine water in presence of the starch solution to make tests for hydrobromic and hydriodic acids, in which the odor of chlorine indicates when sufficient of this reagent has been added.

ANILINE COLORS AND SALICYLIC ACID IN ARTICLES OF FOOD AND DRINK.[1]

By Charles H. LaWall.

It would be impossible in a paper like the following to attempt to give a comprehensive account of the various methods used by analytical chemists in examining the innumerable substances which are brought to them for investigation, but there are certain substances whose presence in an article of food or drink absolutely brings it under the ban as far as the State food law is concerned, and the recognition and identification of which is a comparatively easy matter, even to one whose knowledge of analytical processes is very slight.

The so-called "pure food crusades," which are so frequently heralded by the newspapers and the trade journals, and which are made to serve as the target of many bad jokes, to say nothing of the malignant attacks to which those persons who are engaged in enforcing the laws are often subjected, are simply the occasional attempts on the part of the authorities of the State to enforce laws which are on the statute books, and which should be enforced all of the time if they are to have any salutary effect whatever.

There is no use in arguing the question as to the real harm in the prohibited substances, as it is, after all, not so much a question of the injury to health as a question of fraudulently manipulating inferior products so as to enable the seller to obtain the price of a much higher class of goods.

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[1] Read at the twenty-seventh annual meeting of the Pennsylvania Pharmaceutical Association, June 21–23, 1904.

The cry of "salicylic acid" has so influenced the popular mind that many persons are under the impression that the substance in question is an injurious product of solely artificial origin, and that its physiological effect is but slightly less injurious than that of arsenic itself. It would no doubt surprise many of these persons to learn that an ordinary wintergreen lozenge contains as much salicylic acid (combined as methyl salicylate) as the average tumbler of jelly which has been preserved with this substance; but such is certainly the case, as any one who desires may verify for himself.

The presence of aniline colors and salicylic acid being most important then, from the standpoint of compliance with the food law, more prosecutions being based on these substances than on all others put together, many persons feel entirely safe from prosecution when assured of the absence of these products from the articles which they are handling, and it is the object of this paper to show the retail druggist how he can easily and effectually determine the presence or absence of these substances at least.

In looking for the presence of aniline colors in articles of food and drink, it will be remembered that the range of colors which it is customary to use is somewhat limited, being confined principally to the reds, yellows and browns, very few articles of this nature being colored either green or blue.

The first step in the operation of testing for the presence of aniline or coal-tar color is the selection and preparation of some fat-free woolen goods. For this purpose a good quality of nun's-veiling is obtained and freed from fat by boiling it, first in a five per cent. solution of sodium hydroxide for a few minutes, and then repeatedly in pure water until the alkali has been entirely removed. This material is then cut into strips of a uniform size (about 1 x 2 inches), and preserved in a wide-mouth, glass-stoppered bottle until it is to be used.

The material to be tested, if a liquid, is to be diluted with an equal volume of water; if it is a solid or a semi-solid it is to be dissolved in about four times its weight of water, and the liquid strained to remove particles of fruit pulp or cellular tissue, which would adhere to the wool and interfere with the results. About 100 c.c. (or 4 fluid ounces) of the liquid is placed into a beaker, 4 c.c. (or 1 fluid dram) of diluted hydrochloric acid (10 per cent.) is added, a single strip of the woolen goods is immersed in the liquid and the

contents of the beaker are then boiled for five minutes. The cloth is then removed, washed in cold water, and then boiled for five minutes in water which has been very slightly acidulated with hydrochloric acid.

If the coloring matter be of fruit or vegetable origin, the cloth will either be uncolored or will be changed to a very faint pink or brown tint. If coal-tar or aniline colors have been used, the cloth will be dyed a bright pink, red, yellow or brown, according to the color present. To confirm the results, remove the cloth from the acidulated liquid, wash it well in water, place it in a beaker with a little water and add a few drops of stronger ammonia water. Vegetable or fruit colors will not dissolve, but will change to a green, purple or yellow color. Aniline or coal-tar colors will not be changed in color, but will be dissolved, especially when the solution is heated to boiling; after which, upon the removal of the cloth, acidifying as in the original dyeing test, inserting a fresh piece of cloth and boiling as before, the color will again be deposited.

This second dyeing test is considered an absolute proof of the presence of added coloring matter, as no fruit colors have yet been found which will be deposited upon the wool the second time, while aniline colors will always be so deposited.

When cochineal is present a bright color is obtained with the first dyeing which might be mistaken for an aniline color; but when the ammonia water is added in preparing it for the second dyeing, the red color changes to purple, and the second dyeing comes out practically colorless.

In testing for salicylic acid, the material is to be prepared as in testing for coloring matter, except that it is to be acidulated with sulphuric acid instead of hydrochloric acid. After acidulating, about 50 c.c. (or 2 fluid ounces) of the liquid is placed in a tall cylindrical stoppered graduate (a tall cylindrical bottle will answer the purpose) and a layer of ether poured on the top (about one-fourth as much ether as the liquid to be extracted). The contents of the cylinder are then mixed by inverting it a number of times, taking care not to agitate the contents too violently, which would cause the formation of an emulsion.

After complete separation of the ethereal layer has taken place, about 10 c.c. (or 2 fluid drams) are cautiously removed by careful decantation or the use of a pipette, transferred to a watch glass, and the ether allowed to evaporate at a low temperature.

If salicylic acid be present in notable quantities the residue upon the watch glass will be distinctly crystalline; if but small quantities are present, the residue will have the appearance of small oily drops arranged in a circle near the circumference of the watch glass. The addition of a few drops of water and a drop of a dilute solution of ferric chloride (a dilute solution of ammonio-ferric alum is preferred by some) will develop the characteristic purple color of ferric salicylate, which is positive evidence of the presence of salicylic acid.

If a flesh-colored precipitate is obtained in this test instead of a violet coloration, it is proof of the presence of benzoic acid, the processes for the extraction of these principles being identical.

When the liquid which is to be tested for salicylic acid contains tannin, it will be necessary to change the preliminary manipulation somewhat, as tannin would be extracted by the ether, and thus obscure the ferric salicylate reaction. In cases of this kind, the liquid, instead of being acidulated with sulphuric acid at the outset, is treated with solution of lead subacetate, which precipitates tannin, coloring principles, etc. It is then filtered, and sufficient sulphuric acid is added to the filtrate to precipitate the excess of lead and render it slightly acid. After filtering out the insoluble lead sulphate the liquid is treated according to the foregoing directions.

AMERICAN PHARMACEUTICAL ASSOCIATION.

FIFTY-SECOND ANNUAL MEETING.

By M. I. Wilbert.

The fifty-second annual meeting of the American Pharmaceutical Association was called to order by President Lewis C. Hopp, in the Casino, at Kansas City, Mo., at 3.25 on the afternoon of Monday, September 5, 1904. After a short prayer by the Rev. Dr. Talbot, of Kansas City, the president of the local pharmaceutical association, H. Y. Riddle, welcomed the visitors to Kansas City on behalf of the local retail druggists, and then introduced the Mayor of Kansas City, the Hon. J. H. Neff, who welcomed the visitors on behalf of the citizens. Henry P. Hynson, of Baltimore, was asked to reply to the address of welcome made by the Mayor, and Joseph L. Lemberger, of Lebanon, Pa., responded to the address by Mr. Riddle.

After receiving the credentials of delegates from a number of national as well as State and local associations, the President, Lewis C. Hopp, Cleveland, O., read his address. This address was subsequently referred to a committee composed of F. W. Meissner, Laporte, Ind.; Fabius C. Godbold, New Orleans, La.; Chas A. Rapelye, Hartford, Conn.

Reports of committees were asked for. The Association then adjourned to select the several members of the Nominating Committee. In the subsequent report of the several States it developed that no less than twenty-eight States and Territories were represented by members present.

The reading of the minutes of Council precipitated considerable discussion as to the desirability of changing the official program. The amended program, recommended by W. C. Wescott, of Atlantic City, and seconded by Chas. Holzhauer, of Newark, N. J., finally prevailed. This recommendation provided for two extra evening sessions, so as to conclude the business of the Association on Friday evening in place of Saturday afternoon, and in this way secure an extra day at the St. Louis Fair for such of the members as were interested in that exhibition.

The official program, as finally adopted, was:

Monday, September 5th.

10.00 A.M. Council meeting.
3.00 P.M. First general session at Casino.
8.00 P.M. Reception to visitors, followed by dance.

Tuesday, September 6th.

10.00 A.M. Second general session.
3.00 P.M. Session of the Section on Commercial Interests.
8.00 P.M. Session of the Historical Committee.

Wednesday, September 7th.

9 30 A.M. Session of the Section on Pharmaceutical Education and Legislation.
1.00 P.M. Excursion to Fort Leavenworth.
8.30 P.M. Session of the Section on Practical Pharmacy and Dispensing.

Thursday, September 8th.

10.00 A.M. Second session of the Section on Pharmaceutical Education and Legislation.
2.30 P.M. Session of the Section on Scientific Papers.
8 00 P M. Dinner and dance at Elm Ridge Club.

Friday, September 9th.

10.00 A.M. Second session of the Section on Scientific Papers.

3.00 P.M. Second session of the Section on Practical Pharmacy and Dispensing.

8.00 P.M. Last general session.

In addition to the above program the local pharmacists had arranged an elaborate program of social events for the ladies and such of the visitors as did not care to take part in the scientific meetings.

On September 6, 1904, the meeting was called to order by President Hopp, in the Casino, at 10.45 A.M. After the reading of the minutes by the Secretary, Charles Caspari, Jr., Mr. Faxon welcomed the members of the Association on behalf of the N. W. D. A., and Wm. McIntyre, of Philadelphia, presented greetings from the N. A. R. D.

Several amendments to the by-laws were proposed.

The Treasurer, S. A. D. Sheppard, who is also a member of the Board of Trustees of the U.S.P., read a communication regarding the probable appearance of that book. This was received with thanks.

The election of officers for the ensuing year resulted as follows:

President, Jas. H. Beal, Scio, O.; First Vice-President, P. C. Candidus, Alabama; Second Vice-President, Wm. Mittelbach, Missouri; Third Vice-President, Julius Koch, Pennsylvania; Treasurer, S. A. D. Sheppard, Massachusetts; General Secretary, Chas. Caspari, Jr., Maryland; Reporter on Progress of Pharmacy, C. Lewis Diehl, Kentucky. Members of Council, Joseph L. Lemberger, Pennsylvania; F. W. Meissner, Indiana; L. C. Hopp, Ohio.

The third and last general session of the American Pharmaceutical Association was called to order by the president, Mr. Hopp, on the evening of Friday, September 9th. After the presentation of greetings from the several delegates from various departments of the Government, the report of the Committee on the Time and Place of Next Meeting was called for. This committee presented a majority report for Atlantic City, N. J., and a minority report for Cambridge Springs, Pa. After some discussion the majority report was adopted.

The Committee on the President's Address, in its report, concurred in several of the recommendations made by the president. These were taken up seriatim and discussed.

The report of the Committee on Membership showed a total of 230 new members added since the meeting at Mackinac last year.

After the installation of the officers, for the ensuing year, the Association adjourned to meet in Atlantic City, N. J., on the first Monday in September, 1905.

SCIENTIFIC SECTION.

The Section on Scientific Papers held its first meeting in the Banquet Hall of the Coates House, September 8, 1904, at 2.30 P.M.

The chairman, Prof. W. A. Puckner, requested Chas. E. Caspari, of St. Louis, to occupy the chair while he read the recommendation of the committee of the section and presented his address.

The latter being printed he was, on motion, granted permission to present the same by title.

The Committee on Ebert Prize did not make any definite recommendations.

The report of the Committee on Drug Adulterations, through its chairman, E. H. Gane, of New York, included a number of suggestions and recommendations which if followed by practical and scientific pharmacists would tend to materially improve our drugs and chemicals.

The report of the Committee on Thymol Di-iodide Preparations, appointed last year, was read by Professor Kremers, who gave a résumé of the work, and the resulting figures as given by three independent workers. The resulting figures were then compared with those on the packages exhibited at Mackinac Island, and were found to differ very materially.

Considerable discussion, as to the proper course to be pursued to make amends to the several firms who had been wrongfully accused, followed. It was finally agreed to recommend the publication of the report with the ensuing discussion, in full, in the proceedings of the Association.

Following are the papers presented to this section:

The Relation Between Chemical Constitution and Physiological Action of Certain Organic Bases.

By Prof. Ernst Schmidt, Marburg, Germany.

The above paper was presented and read by title.

Chemical Examination of Cascara Sagrada.
By H. A. D. Jowett, London.

This valuable and exhaustive paper was presented, in abstract, by the Secretary, E. H. Gane. It consists of a review and criticism of the work of previous investigators, and also embodies an account of numerous experiments that were made to determine, if possible, the active constituents of the bark.

Notes on the Pharmacology of Cascara Sagrada and Bitterless Preparations of Cascara.
By Burt E. Nelson.

This paper, also read by Mr. Gane, contains an account of some observations made with fractions of extracted cascara bark.

Balsam Copaiba.
By A. R. L. Dohme.

The author gave an abstract of a paper embodying a review of a systematic examination of a number of samples of balsam copaiba. Several of these samples were found to be adulterated with ordinary rosin (colophony); one sample labeled para balsam was grossly adulterated.

Aloes and Aloins.
By A. R. L. Dohme.

The author severely criticises a paper recently read before the New Jersey State Pharmaceutical Association that ostensibly embodied a ready method for preparing aloin.

The author also recounts a number of experiments that were made to determine the practicability of using Tschirsch's method of separating and purifying aloin.

Acetic Acid Fluid Extracts.
By A. R. L. Dohme.

The author believes that alcohol is, in the majority of conditions, a most important and desirable addition to medicinal fluid extracts.

The author also reports on a number of disadvantages that have developed to the systematic use of acetic acid in the making of fluid extracts; among others he cites the destruction of several of the active principles of crude drugs.

Fatty Oil of Mandrake.

By A. R. L. Dohme.

The author read a preliminary report on a thick, fatty oil found in some samples of mandrake, particularly in root that had been dug in the spring of the year.

The Introduced and Native Medicinal and Poisonous Plants of California.

By Albert Schneider.

An exhaustive treatise on the medicine plants of California.

This paper being too voluminous to be embodied in the proceedings of the Association, Professor Schneider agreed to furnish an abstract covering four or five pages, and to have the paper itself published elsewhere.

The session then adjourned.

On September 9th, 10 A.M., the second session of this section was called to order by the chairman, W. A. Puckner, after which the presentation of papers was continued.

The Alkaloid Calycanthin.

By H. M. Gordin.

The author records an exhaustive investigation into the physical, chemical and physiological properties of calycanthine, an alkaloid found in the seeds (achenes) of *Calycanthus glaucus*.

Epsom Salt.

By M. I. Wilbert.

This paper, accompanied by a number of samples, was designed to call attention to the frequently unnecessary admixture of foreign materials to magnesium sulphate and other heavy chemicals.

Cod-Liver Oil.

By J. P. Remington, Jr.

This paper, read by the Secretary, Mr. Gane, contains a discussion of the physiological and physical properties of cod-liver oil, and recommends that the oil be tested by pharmacists to insure purity.

Tests for the Purity of Cod Liver Oil.

By E. H. Gane.

Contains a description of a number of tests for cod-liver oil readily applied by retail pharmacists.

The Quinhydrone Hypothesis of Plant Pigmentation.
By E. Kremers.

This paper, presented in abstract by the author, embodies a study of plant pigments with a view of showing their probable relationship.

On the Curing of Leaf Drugs.
By R. H. True and Mr. Stockburger.

Presented by W. O. Richtmann, of the Bureau of Plant Industry.

The authors of this paper believe that leaf drugs are largely bought on their physical appearance. This appearance is, therefore, an important factor to be sought in this class of drugs.

The writers discuss the probable changes that take place in the coloring matter of plants, and also suggest methods of preventing undesirable changes in color in the drying of leaf drugs.

The report of the committee on the Chairman's address and on the report and recommendations of the committee of the section was then read by Professor Koch, of Pittsburg.

Chemical Reagents.
By Lyman F. Kebler.

This paper embodies the results of the analysis of a number of chemical reagents supplied the Bureau of Chemistry, and emphasizes the importance of not depending on labels.

A Preliminary Report on the Presence of Nitrogen and Nitrates in Medicinal Plants.
By Lyman F. Kebler.

Contains a preliminary announcement of a proposed study on the economic value of the presence of fixed nitrogen in solanaceous plants.

Notes on the Methods of Detection of Adulteration in Olive Oil.
By L. M. Tolman.

This paper, presented by Lyman F. Kebler, contains a résumé of the most useful tests, at present available, for detecting common adulterants of olive oil.

Co-operative Work on Opium Assaying.

By Lyman F. Kebler.

This paper embodies an account of the results obtained by a number of independent workers, who were asked to analyze a sample of opium supplied by the Bureau of Chemistry.

Examination of Official Drugs.

By Daniel Base.

The author has examined 115 specimens, the majority of which were acceptable, conforming more or less closely to the demands of the U.S.P. But two of the drugs were found to be grossly adulterated—asafœtida and oil of wintergreen. Iodoform gauze was found to be deficient in iodoform, being but one-half the advertised strength.

The Determination of Codeine in Opium.

By Chas. E. Caspari.

The author describes, in detail, a satisfactory method for the determination of codeine in opium.

The Use of Potassium Biiodate for Standardizing Volumetric Solutions.

By Chas. E. Caspari.

In this paper the author records some observations made on the use of potassium biiodate for standardizing volumetric solutions of sodium thiosulphate, iodine, potassium permanganate, silver nitrate and alkalies.

The Need of Greater Care in the Testing of Clinical Thermometers.

By Caswell A. Mayo.

In this paper the writer records the varying results that were obtained by submitting the ordinary clinical thermometers to examination at the Bureau of Standards in Washington.

Saponin as an Emulsifying Agent.

By H. P. Hynson and H. A. B. Dunning.

The authors assert that from a practical point of view saponin is a very desirable emulsifying agent; whether or not it is sufficiently toxic to be objectionable or dangerous, is still an open question.

Sodium Bicarbonate in Iodometric Determinations.

By W. A. Puckner.

The author asserts that by using dilute solutions of sodium bicarbonate, saturated with carbon dioxide, more reliable results are obtained, in the volumetric estimation of phosphites by oxidation with iodine in presence of sodium bicarbonate.

After the installation of the newly-elected officers, E. H. Gane, New York, Chairman, and Chas. E. Caspari, St. Louis, Mo., Secretary, the section adjourned.

SECTION ON EDUCATION AND LEGISLATION.

The first session of the Section on Education and Legislation was called to order by the chairman, H. B. Mason, in the club-room of the Coates House, on Wednesday morning, September 7, 1904.

J. O. Schlotterbeck was requested to take the chair while the chairman read his address.

This address contains quite an exhaustive review of the present status of education and legislation directly affecting pharmacists.

Some exception being taken to the statement that the Illinois anti-cocaine law was a success, the chairman willingly accepted the correction and agreed to omit the reference to the Illinois law from his address.

Following the chairman's address the secretary of the section, Wm. L. Cliffe, of Philadelphia, presented a résumé of legislation that had been attempted or perfected during the past year in the several States and Territories.

The next order of business was the presentation of the final draft of an "Anti-Narcotic Law," by the committee appointed last year; this consisted of James H. Beal, C. S. N. Hallberg and E. G. Eberle.

After some discussion the draft as amended was endorsed by the section.

The present officers were renominated.

The following papers were then presented:

The Consolidation of the New York College of Pharmacy with Columbia University.

By H. H. Rusby.

This paper was read by title and referred to the Publication Committee.

THE HISTORY OF THE MASSACHUSETTS LAW GIVING THE BOARD OF PHARMACY SUPERVISION OVER DRUGGISTS' LIQUOR LICENSES.
By C. F. Nixon.

This was read, in the absence of the author, by Geo. M. Hoyt.

It embodies a historical sketch of the practical working of this law, from its enactment in 1894, some quoted opinions on the probable use of such a law, and also a copy of such portions of the statutes of Massachusetts as pertain to it.

INTERSTATE REGISTRATION: IS IT PRACTICABLE?
By W. R. Ogier.

This paper contains a number of valid reasons why reciprocity in pharmaceutical registration is impracticable at the present time.

The section then adjourned so as to allow members to join the excursion to Fort Leavenworth, provided by the local committee.

At the second meeting of the Section on Education and Legislation, held Thursday morning, September 8th, the following were elected as officers for the ensuing year:

Chairman, H. B. Mason, Detroit; Secretary, W. L. Cliffe, Philadelphia. Associates, F. B. Hayes, New York; J. T. McGill, Nashville; F. C. Godbold, Louisiana.

The first paper on the programme was:

WHAT DEGREES SHOULD BE CONFERRED BY SCHOOLS OF PHARMACY?
By J. T. McGill.

The author reviews the degrees offered by the various schools at the present time, and deprecates the cheapening of academic degrees by conferring them on students whose professional education is limited to a short course in a few branches of science pertaining to pharmacy.

This paper elicited considerable discussion and was referred, for consideration, to a special committee and also to the conference of teaching faculties.

A COMMERCIAL COURSE IN COLLEGES OF PHARMACY.
By H. P. Hynson.

In this paper Mr. Hynson describes in outline the methods employed in the school with which he is connected, to instruct students in commercial practices. In connection with the paper he exhibited a set of books compiled by one of his students in the regular course.

THE CONSIDERATION OF ALKALOIDS IN SCHOOLS OF PHARMACY.
By W. A. Puckner.

The author discusses the desirability of discarding the teaching of isolated facts relating to alkaloids, and bringing out more prominently the relations of the alkaloids to ammonia and to the alkali metals in their chemical properties.

THE APPRECIABLE ADVANTAGES OF HIGHER AND UNIFORM ENTRANCE REQUIREMENTS TO COLLEGES OF PHARMACY.
By Albert Schneider.

In this paper Professor Schneider refers to the improvements that must necessarily result from the introduction of higher and more uniform entrance requirements to colleges of pharmacy.

THE REQUIREMENT OF GRADUATION FROM A HIGH SCHOOL BEFORE ADMISSION TO COLLEGES OF PHARMACY, AND OF GRADUATION FROM A COLLEGE OF PHARMACY BEFORE REGISTRATION AS A PHARMACIST.
By J. H. Beal.

Professor Beal in this paper referred to the difficulty of suggesting a standard of entrance qualification that would be acceptable to all colleges of pharmacy until graduation from a college of pharmacy is required by law in all of the several States.

THE PREREQUISITE LAW IN NEW YORK.
By Caswell A. Mayo.

The author outlined the provisions of the law recently passed in New York State, and referred to the history of the law and of the several provisions that it contains.

These three papers were discussed simultaneously. The discussion was rather spirited, and resulted in a motion to appoint a special committee to draw up or suggest a desirable prerequisite law that might prove acceptable in States without a board of regents.

Geo. C. Reimann, of the newly-organized association of State Boards of Pharmacy, made a short verbal report.

FOOD LEGISLATION AS AFFECTING PHARMACY.
By R. G. Eccles.

This paper was presented in abstract by the author, who asserted that food preservatives were not harmful, as was sometimes supposed.

Several additional papers were read by title, and the section adjourned.

SECTION ON PRACTICAL PHARMACY AND DISPENSING.

The first meeting of the Section of Practical Pharmacy and Dispensing was held on the evening of September 7th in the banquet hall of the Coates House.

In his address the chairman, William H. Burke, recommended to unite the Section on Practical Pharmacy and Dispensing and the Section on Commercial Interest, so as to obviate to an extent the growing multiplicity of sections. He also discussed the injustice accruing to Pharmacy in America from our present patent laws, and recommended that proper steps be taken to have them amended.

He advised pharmacists to keep in close touch with modern literature, and to strive to keep well posted on new remedies.

In speaking of prices on prescriptions, he recommended that the pharmacist should be allowed reasonable compensation for his efforts.

The report of the chairman of the National Formulary Committee, Prof. C. L. Diehl, precipitated considerable discussion.

It was recommended that alternative formulas be included in the coming edition of the National Formulary. This proposition was, on motion, adopted.

A motion to instruct the committee to include abbreviated or coined names was lost after considerable discussion, the opinion prevailing that the instructions already given the committee were sufficiently broad to cover any desirable changes.

On motion of Leo Eliel, duly seconded, it was recommended that the use of all or any portion of the text of the National Formulary be not allowed without adequate compensation. This was adopted.

DEVELOPING A PRESCRIPTION BUSINESS.
By Wm. A. Kirschgessner.

This paper contains a number of suggestions on how the prescription business of a drug store may be developed along profitable lines in a comparatively short time.

After considerable discussion the section adjourned at 12.30 A.M.

The second session of the Section of Practical Pharmacy and Dispensing was called to order by the chairman, Mr. Burke, in the

banquet hall of the Coates House, on Friday afternoon, September 9th.

The following papers were presented:

ELIXIR CARICA-PAPAYA.

By Wm. C. Kirschgessner.

Made by mixing two solutions as follows: (1) Alcohol, 120 c.c.; compound spirit of orange, 6 c.c.; syrup, 120 c.c.; mix. (2) Solution of potassa, U.S.P., 5·5 c.c.; water (hot), 240 c.c.; papain, 17 c.c.

NEW PRESCRIPTION FILE.

By M. I. Wilbert.

This paper contains a description and cut of a prescription file used at the German Hospital, Philadelphia.

SOME PREPARATIONS OF THE NATIONAL FORMULARY.

By Wilbur L. Scoville.

The author exhibited a number of specimens of preparations made from formulas that are proposed for admission into the new edition of the National Formulary, and discussed their relative merits.

CONTAINER FOR FLUIDS THAT TEND TO SPOIL WHEN EXPOSED TO AIR.

By E. H. Gane.

In this paper the author describes a copper container, made so as to stand a pressure of 20 pounds to the square inch and so arranged that it may be connected to a cylinder of carbon dioxide.

WAX IN SUPPOSITORIES.

By Wilbur L. Scoville.

The author recommends the use of spermaceti in preference to white wax, and believes that in moderate quantities it does not raise the melting point of the resulting suppository sufficient to be seriously objectionable.

SOME DISPENSING NOTES.

By E. A. Ruddiman.

This paper contains a number of practical points that will be of interest to the dispensing pharmacist.

AN ADJUSTABLE LABEL DRAWER.

By M. I. Wilbert.

The author gives a description of a box with open ends, used as a receptacle or holder for stock labels.

Pulvis Ventriculus Callosus Gallinaceus.
By Wm. C. Kirschgessner.

Contains directions for powdering chicken gizzards.

Elixir of Glycerino-Phosphate of Lime and Soda.
By Wm. C. Kirschgessner.

Contains a formula for this preparation.

Glycerole Acidi Hydriodici.
By Wm. C. Kirschgessner.

Contains a formula for this preparation, and also a list of some of the advantages that glycerine has over syrup in preparations of this kind.

Some Green Preparations, and How to Make Them.
By M. I. Wilbert.

The author suggests the possible use of distinctive colors as a desirable addition to well-known preparations, and also records some experiments he has made with the green coloring matter of hemp seed.

Conversion of Weights.

Three communications bearing on this subject were received by the chairmain and read before the section.

Some Points in Dispensing.
By H. P. Hynson.

The author gave a number of examples to illustrate the necessity of considerable technical knowledge to dispense what are sometimes classed as ordinary prescriptions.

Pillular vs. Powdered Extracts.
By Mr. Fisk.

The author recommends the making of uniform powdered extracts having a relative strength of 1 to 5 of the crude drug.

A number of additional contributions were referred to the Publication Committee for their consideration.

After the installation of officers—Chas. A. Rappelye, Hartford, Conn., Chairman; Wm. C. Kirschgessner, Grand Rapids, Mich., Secretary; Miss Stahl, Chicago, Associate—the section adjourned.

HISTORICAL COMMITTEE.

The meeting under the auspices of the Historical Committee was called to order by President Hopp in the club-room of the Coates House, on the evening of September 6, 1904. After a few preliminary remarks the report of the chairman, Edward Kremers, was called. This consisted largely of an outline report of the work that had been accomplished during the past year, and also contained a number of suggestion for work in the future.

S. A. D. Sheppard spoke of a scrap-book that he had prepared while local secretary for the meeting of the A.Ph.A. held in Boston, Mass., in 1875. This scrap-book contains practically a complete history of that meeting from the preliminary announcement to the reports of the meeting as published in the drug journals of that time.

Henry M. Whelpley, of St. Louis, referred to some material that he had collected in connection with the meeting of the A.Ph.A. in St. Louis in 1901, and also in connection with the semi-centennial meeting held in Philadelphia in 1902. In connection with this, Professor Whelpley exhibited a volume containing autograph replies to letters of invitation that had been sent to a number of men prominently connected with pharmacy in several parts of the world.

Professor Whelpley also showed a scrap-book containing a large number of photographs taken by him at the several meetings of the American Pharmaceutical Association that he had attended.

A. E. Ebert exhibited a number of letters written by the late Prof. Wm. Procter and also intimated that he was anxious to secure others if available.

WILLIAM PROCTER, THE FATHER OF AMERICAN PHARMACY.
By John F. Hancock, Baltimore.

In this paper the author described in outline the life and accomplishments of that eminent pharmacist. In this connection Mr. Hancock proposed that the American Pharmaceutical Association undertake the erection of a suitable monument in the grounds of the Smithsonian Institution at Washington.

THE CULTIVATION OF THE OPIUM POPPY IN THE UNITED STATES.
By W. O. Richtmann, Washington.

The author in the course of this interesting paper referred to the

several attempts that had been made in this country to cultivate the opium poppy and to produce opium.

Mr. Richtmann also referred to the several attempts to sell bogus opium in the United States.

Historical Sketch of the Phi-Chi Fraternity.
By J. W. T. Knox, Detroit.

In the course of this interesting sketch it developed that this fraternity had its origin as a scientific society at the Michigan State University at Ann Arbor.

Mr. E. J. Kennedy, of the *Pharmaceutical Era*, New York, referred to a collection of "Druggists' Directories" that he had undertaken, and incidentally referred to some matters of historic interest in connection with them.

Prof. Wilbur L. Scoville, of Boston, presented a price list, published by the Massachusetts College of Pharmacy in 1854, and also spoke at some length of the history and evolution of that institution.

M. I. Wilbert, of Philadelphia, referred to the fact that, as yet, he had not received any Maisch letters, but was hopeful that the future would be productive of better results.

Mr. Wilbert also referred to a paper that he had presented on "The Beginnings of Pharmacy in America," in which he recounted some early practices in the dispensing of medicines and also records what little is known of the introduction of lectures on pharmacy in America.

Wm. McIntyre, of Philadelphia, presented a copy of the menu of the banquet held in connection with the meeting of the American Pharmaceutical Association in St. Louis in 1871.

It having been proposed to develop the Committee on Historical Pharmacy into a regularly organized section it was moved that the chairman of the committee be asked to confer with the committee on the president's address with a view of establishing a Section on the "History of Pharmacy."

On motion it was also proposed to appoint a committee of three to confer with the managers of the Smithsonian Institution, or the National Museum, with a view of having established in either of these institutions a national pharmaceutical museum.

Several additional papers were read by title, among them:

"The Founding of the Lloyd Library," by J. U. Lloyd; "The

Drugs of Primitive Peoples;" "The Rites Observed in the Collection of Camphor by the Borneo Head Hunters;" "Pharmaceutical Notes from Cummins' Tour to the West," by Edward Kremers.

After the regular business had been dispensed with M. I. Wilbert exhibited a number of slides of early drug stores in Philadelphia.

SECTION ON COMMERCIAL INTERESTS.

The section on commercial interests was called to order in the Casino, on the afternoon of September 6th, by Robert C. Riley, the Secretary, who read a letter from W. L. Dewoody, the Chairman, presenting his regrets that he was unable to attend. In the absence of Mr. Dewoody, Chas. R. Sherman, one of the associates, was requested to take the chair.

Pay Telephones or Deadhead Telephones.

By John I. Straw, of Chicago.

The principles involved in this paper were discussed at some length by several of the members present. In the course of the discussion it developed that in some of the cities of the Middle West pharmacists have been enabled to make quite satisfactory arrangements with the telephone companies.

The Deficiency in the Supply of Assistant Pharmacists and the Necessity for a Longer Probationary Period.

By Jas. H. Beale, of Ohio.

Professor Beal believes that the present scarcity of drug clerks is largely due to the fact that the probationary period, according to the State pharmacy laws, is altogether too short.

Department Accounts.

By H. P. Hynson, of Baltimore.

In which the author gave, in outline, a description of a system of accounts that may be applied to the wants of retail pharmacists.

Prices and Qualities of Chemicals.

By Lyman F. Kebler.

The author discussed the probable relation that the prices quoted on chemicals usually bear to the quality of the chemicals as supplied.

The election of officers for this section resulted as follows:

Chairman, Chas. R. Sherman; Secretary, R. C. Riley; Associates, Mathias Noll Acheson, Frank H. Carter, Oscar W. Bethea.

EDITORIAL.

THE INTERNATIONAL CONGRESS OF ARTS AND SCIENCE.

Whatever may be said of the scope and purpose of the Louisiana Purchase Exposition, it must be admitted that the International Congress of Arts and Science, held under its auspices, was most successful, not only in the attendance, but also in the character of the work done. The Congress was well managed, and as a result was attended by a very large number of the most eminent leaders of thought. During the six days of meeting, from September 19–24, 128 sectional meetings were held, in which there were at least two principal addresses, these being followed in some cases by brief communications.

It appears that the idea of an international congress originated at the Paris Exposition in 1889. This was followed by the World's Congress Auxiliary at the World's Columbian Exposition, held in Chicago in 1893, and by that of a series of congresses held at the Paris Exposition in 1900. In all these congresses the main object was to bring together the most eminent men of the world to discuss the results already attained in their respective fields of research. The Congress in St. Louis was more comprehensive, the purpose being to have an assemblage "at which leading representatives of theoretical and applied science shall set forth those general principles and fundamental conceptions which connect groups of sciences, review the historical development of special sciences, show their mutual relations and discuss their present problems."

It is doubtful if such a gathering of eminent men of science was ever held before. Perhaps the mention of a few of the names of those who were in attendance will verify this statement. Of the some ninety foreign scientists and men of letters present we mention: Prof. Wilhelm Ostwald, University of Leipzig; Prof. Henri Poincaré, of the Sorbonne, Paris; Sir William Ramsay, of the Royal Institution, London; Prof. Henri Moissan, of the Sorbonne, Paris; Prof. J. H. Van t'Hoff, University of Berlin; Prof. Svante Arrhenius, University of Stockholm; Prof. Hugo de Vries, University of Amsterdam; Prof. F. O. Bower, University of Glasgow; Prof. Karl F. Goebel, University of Munich; Prof. Julius Wiesner, University of Vienna; Prof. Oskar Drude, of the Kön. Technische Hochschule, Dresden; Prof. Oskar Hertwig, University of Berlin; Prof. Max Verworn,

University of Göttingen; Prof. Ronald Ross, School of Tropical Medicine, University College, Liverpool; Sir Lander Brunton, London; Sir Felix Semon, Physician Extraordinary to His Majesty, the King, London; Prof. Theodore Escherich, University of Vienna.

There were over 400 American men of science and letters who took an active part in the meeting. We select the names of a few, viz.: Prof. Josiah Royce, Harvard University; President Woodrow Wilson, Princeton University; President William R. Harper, University of Chicago; President Ide Wheeler, University of California; Prof. Francis A. March, Lafayette College; Prof. John W. Mallet, University of Virginia; Prof. A. B. Prescott, University of Michigan; Prof. W. O. Atwater, Wesleyan University; Prof. Russell H. Chittenden, Yale University; Prof. Edward C. Pickering, Director of Harvard Observatory; Dr. Abbott L. Rotch, Blue Hill Observatory; Prof. William G. Farlow, Harvard University; Prof. C. O. Whitman, University of Chicago; Prof. William K. Brooks, Johns Hopkins University; Prof. Frederick W. Putnam, Harvard University; Dr. Edward C. Spitzka, New York City; Prof. William Osler, Johns Hopkins University; Prof. William T. Sedgwick, Massachusetts Institute of Technology; Dr. George M. Gould, Philadelphia; Prof. Abraham Jacobi, Columbia University; Prof. Michael I. Pupin, Columbia University; Prof. Liberty H. Bailey, Cornell University; Hon. William T. Harris, U. S. Commissioner of Education; President Arthur T. Hadley, Yale University; Prof. Hugo Muensterberg, Harvard University.

At the opening meeting of the Congress, addresses were made by President Francis, of the Louisiana Purchase Exposition; Dr. William R. Harper and Dr. Frederick J. V. Skiff, members of the Administrative Board of the Congress; Prof. Simon Newcomb, President of the Congress, and the several Vice-Presidents of the Congress.

All of the addresses and communications in each department will be collected and published in a special volume.

Any one who attended, day after day, this "six-day Autumn school," as it was termed by Professor Muensterberg, could not help but catch the prevailing note of the Congress, as expressed by Professor Harper in his address on the opening day, viz., the unification of knowledge. "Let us," he says, "confidently assure ourselves

that the great purpose which has throughout controlled in the different stages of its organization will be realized; that because the Congress has been held the nations of the earth will find themselves drawn more closely together; that human thought will possess a more unified organization and human life a more unified expression."

THE SOCIETY OF CHEMICAL INDUSTRY.

The annual general meeting of the Society of Chemical Industry was held for the first time outside of the British Isles, in New York City, beginning September 7th. The meeting was unique in one respect, in that only one address was made and that by the retiring President, Sir William Ramsay. The rest of the time allotted to the meeting was devoted to entertainment and sight-seeing, which was probably well in view of the intellectual feast afforded the members later at the International Congress of Arts and Science, for here chemistry in its various branches was most ably represented and most valuable papers were read.

An interesting feature of the meeting in New York was the presentation of the Barnard gold medal of the Society for research in applied chemistry to Professor Ira Remsen, president of Johns Hopkins University. It is also gratifying to know that the newly elected president of the Society, W. H. Nichols, is an American. Mr. Nichols is one of the foremost electrical chemists of the United States.

In his address before the Society, President Ramsay took for his theme "The Training of the Chemist." He touched upon some vital points in educational work and for this reason we give a brief abstract of his address:

This education should primarily consist in an effort to produce an attitude of mind, rather than to instil definite knowledge; to cultivate the inventive faculty, though, of course, a vast amount of knowledge will be gained during the process of training.

Anticipating the objection that it is not possible to create an inventive mind, he pointed out that most of the young men who enter a chemical laboratory do so from choice; and the choice is due, in most cases, to the existence in their minds of a germ of the power of research and suggestion, which needs development and cultivation.

In considering the best method of cultivating this power Professor Ramsay recommended the force of example; inculcating the doc-

trine that every teacher in the laboratory should be engaged in research, and should be willing to discuss the problems upon which he is engaged; it is thus that a "chemical atmosphere" can be created. In order that the students shall gain as much as possible from each other, the various departments of chemistry should not be walled off. The best instruction which a student can get, he acquires in having to explain his operations to his neighbors. Hence inorganic, organic and physical students should work in the same room, and care should be taken to intermingle seniors and juniors.

One advantage of this system is that the lesson is soon learnt to judge of a man's capacity by his achievements rather than by his knowledge. Mechanical accomplishments are by no means to be despised. Every man should become a glass-blower by imitation and by trial; not by direct instruction; the mechanical operations of soldering, repairing, joiner's and brass work are learned without direct teaching.

A fairly good student should have gained such powers in one and a half or two years as to be able to help himself in facing an analytical problem which he has not previously attempted. By mixing research students with others at all stages of advancement, the man who is working at analysis insensibly gets to regard his operations as partaking of the nature of a problem, and pursues his work with greater interest. It is possible, with a little ingenuity, to make routine analytical work partake more or less of the nature of a problem; and the junior student's analytical skill may often be utilized for purposes of research, in helping more advanced students with their work.

Professor Ramsay emphasized the fact that in many cases the student is overtaught. But it may be said that if he is allowed to struggle on, his progress will be painfully slow. "Yes; possibly at first. But the ultimate rate of progress is much more rapid. Unless the pupil learns to be of use to himself, he cannot possibly be of use to others. The training consists in finding out how to do it; not in doing it; that is easy, if one knows how."

Passing on to the junior staff, it was insisted that at least half the time of assistants should be their own. It is unjust to treat assistants as mere teaching-machines; their advancement depends on their becoming known; and their becoming known involves publication of the results of their work. It should also be part of the

duty of assistants to suggest and superintend the working out of problems set to students; in this way, he is apprenticed to his trade.

As the number of assistants must necessarily be greater than that of professors, and as assistants should, as a rule, be birds of passage, it follows that some should be drafted off into industry. As in Germany, so our manufacturers would find it to their advantage to induce assistants from University laboratories to enter their works.

It is not possible for any man to supervise the work of more than forty or fifty men, even if he is well provided with assistance. The reason why the laboratories of Liebig, Wöhler and Bunsen were regarded with such loving memory by their old students is that the total number of students was small, and each came under the influence of the great teacher. Too much time, also, should not be spent by the professor in the duties of organization. If too many students flock to any one laboratory, let a new one be built, and a new chair be created.

Professor Ramsay next considered the question of remuneration, and pointed out that if first-rate men are to be tempted to choose a university career, the prizes to the most successful should bear comparison to those gained by the successful physician, lawyer or manufacturing chemist. It is not necessary that all should be paid at such rates; but if some are not, the teaching profession will fail to attract, and second-rate men will fill university chairs.

The subject of examinations was next touched on; and stress was laid on the danger of an examination being so contrived as to elicit what a man knows rather than what he can do. The danger of scholarships reaching the wrong men, and their award fostering wrong aims, was also alluded to.

A question sometimes debated is whether the professor should lecture to junior or to senior students. The object of a course of lectures is to open out a subject, and to direct a student how to read, rather than to give definite information. Students are generally much overlectured; and it is doubtful whether lectures should be continued in a formal manner for longer than the first two years of the student's career. But, as some learn best through the eye, and some best through the ear, it is advisable to make use of both channels of approach to the brain, at all events in beginning each division of chemistry. Lectures on technical subjects appeared to the speaker to be futile.

The last part of the address was devoted to the consideration of a possible association which should fulfil a double function—that of giving a practical training to future technical chemists, and that of encouraging invention.

NATIONAL PHARMACEUTICAL ASSOCIATIONS.

During the months of August and September, three national meetings of special interest to pharmacists were held, viz.: the thirty-third Annual Conference of the Deutscher Apotheker-Verein, at Hamburg; the forty-first Annual Meeting of the British Pharmaceutical Conference, at Sheffield; and the fifty-second Annual Meeting of the American Pharmaceutical Association, at Kansas City.

The meeting in Hamburg was held in connection with an exhibition of chemical and pharmaceutical products and apparatus, and was attended by representatives from Austria-Hungary and Holland. The meeting was in the main devoted to the consideration of the education of pharmacists and to pharmaceutical legislation.

The question of the educational requirements was brought up on behalf of the council by Dr. Bedall. The government examination, which became operative on October 1st, requires a "prima" grade of certificate as a condition of entrance to pharmacy; whereas the Society had previously sought the introduction of the "maturum" grade. A resolution was submitted to the effect that it was the sense of the meeting that the requirement of a "prima" grade of certificate was only a temporary provision, which would soon be followed by the requirement of a certificate of a gymnasium or a real gymnasium.

The meeting of the British Pharmaceutical Conference must be voted a success. The presidential address of T. H. W. Idris on "A Year's Progress in Pharmacy," showed that the speaker had the best interests of British pharmacy at heart. There were some fifteen papers presented, most of which elicited a considerable amount of discussion, and some of these we hope to abstract later on.

It will be seen from the account of the proceedings of the American Pharmaceutical Association, published elsewhere in this number, that the Association is alive to the best interests of American pharmacy.